Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

SHOUT
SHARE
IT

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 762

Contribution from the Bureau of Animal Industry
JOHN R. MOHLER, Chief

Washington, D. C. ▼ March 12, 1919

A COMPARISON OF ROUGHAGES FOR FATTENING STEERS IN THE SOUTH.

By W. F. Ward, Animal Husbandry Division, Bureau of Animal Industry, Dan T. Gray, Formerly Professor of Animal Industry, Alabama Polytechnic Institute, and E. R. Lloyd, Director of Mississippi Experiment Station.[1]

I. A Comparison of Cottonseed Hulls, Corn Silage, and a Combination of Cottonseed Hulls and Silage for Fattening Steers During a Short Feeding Period. (Alabama Experiment, 1913–14.)

II. A Comparison of Cottonseed Hulls, Corn Silage, and a Combination of Cottonseed Hulls and Silage for Fattening Steers. (Mississippi Experiment, 1914–15.)

III. A Comparison of Some Common Farm-Grown Roughages for Fattening Steers. (Experiment of 1915–16.)

IV. A Comparison of Some Common Farm-Grown Roughages for Fattening Steers. (Experiment of 1916–17.)

V. Summary and Conclusions of the Four Years' Work.

INTRODUCTION.

The investigations reported in this bulletin are a continuation of the cooperative work started in 1904 between the Bureau of Animal Industry and the Alabama State experiment station. Previous results will be found in Bureau of Animal Industry Bulletins 103, 131, 147, and 159, and Department of Agriculture Bulletins 73 and 110.

The map (fig. 1) shows the general location of the farms in Alabama and Mississippi where the experiments were conducted and the location of the markets most convenient to the southern farmer and cattleman. The shaded area shows the portion of the South to which the results of this feeding work are directly applicable. In this area the climatic conditions, pasture grasses, and forage crops are very similar to those of western Alabama and central Mississippi.

Since such a large portion of the South has eradicated the cattle tick, there has been quite a change in the movement of cattle to market. Formerly most of the cattle from Alabama and Mississippi were marketed at New Orleans and Mobile. Now practically all

[1] Acknowledgment is due G. A. Scott and S. W. Greene, of the Animal Husbandry Division, United States Department of Agriculture, for assistance in compiling this bulletin.

the cattle from the tick-free sections of these States go to the St. Louis market, where they are sold in the free pens in direct competition with the cattle from the corn belt. The cattle from the tick-infested sections of these States go largely to New Orleans, the Louisiana cattle go to New Orleans, Fort Worth, and St. Louis, and the cattle from Georgia, South Carolina, and North Carolina are shipped to the Richmond, Baltimore, Jersey City, and Jacksonville, Fla., markets. The new stockyards and packing plant at Jacksonville, Fla., will receive many of the Florida and some southern Georgia cattle, while a few may still be exported to Cuba from Tampa.

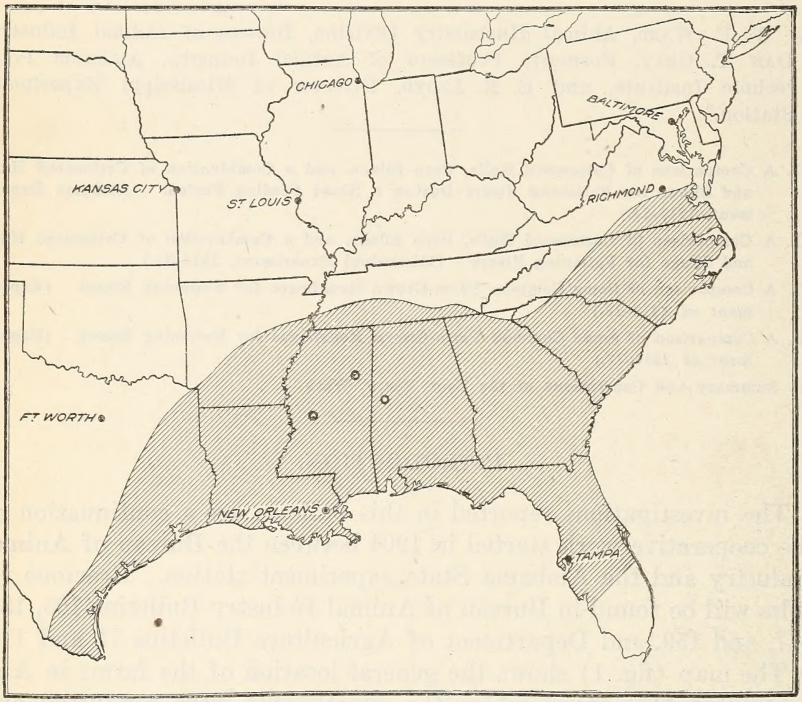

FIG. 1.—The shaded area represents the portion of the United States to which the results obtained in the feeding experiment are applicable. The circles in Alabama and Mississppi show the approxmate location of the test farms. The location of the various cattle markets to which southern cattle are shipped is shown also.

Packing plants at Natchez, Miss., Birmingham, Ala., Moultrie, Ga., and Jacksonville, Fla., are having a stimulating effect on the live-stock industries in those sections, and this influence will grow in proportion to the prices paid for live stock. If prices are paid which compare favorably with those the farmer can get at other available markets less the cost of shipping, then, and only then, will the establishment of such plants exert a permanent influence for good upon the live-stock industry of those sections.

Since the cooperative cattle-feeding work was started between the Bureau and the Alabama experiment station, there has been a growing demand for more definite information concerning the cost of growing or raising cattle and fattening them for the market. In many cases the cooperative experimental work has been the absolute foundation for building up the cattle industry in certain sections.

Many of the cooperative experiments were conducted to determine what concentrates and combinations of concentrates were most desirable to use for fattening steers and calves for the market. The tests reported herein were conducted to determine the comparative value of some of the more common farm-grown and commercial roughages for fattening steers. Cottonseed meal was the sole concentrate used in each of the experiments.

In times gone by cottonseed hulls were the principal and the cheapest roughage used by farmers of the South, but the price of hulls has advanced to such a degree that few farmers can afford to feed them. Then, too, where diversified farming has been taken up more forage is produced upon the farms, and many of the progressive live-stock farmers of the South have one or more silos and are producing much corn silage, corn stover, and leguminous hays upon the farm.

The importation of pure-bred beef bulls in large numbers in every State of the South emphasizes the importance of the growing beef-cattle industry, and with the prevailing high prices of meat animals there has never been a time when studies of various methods of fattening beef cattle were of more importance to the farmers of the South.

The first experiment reported in this bulletin was conducted in cooperation with the Alabama experiment station in western Alabama; the others were conducted in Mississippi in cooperation with the State experment station.

I. A COMPARISON OF COTTONSEED HULLS, CORN SILAGE, AND A COMBINATION OF COTTONSEED HULLS AND CORN SILAGE FOR FATTENING STEERS DURING A SHORT FEEDING PERIOD (ALABAMA EXPERIMENT).

This is the last of a series of cooperative cattle-feeding experiments conducted in western Alabama by the Bureau of Animal Industry and the Alabama experiment station for the purpose of testing various concentrates and roughages for fattening steers for the market. The results of the previous work have been reported in Bureau of Animal Industry Bulletins 103, 131, and 159, and Department Bulletin 110.

OBJECTS AND PLAN OF THE WORK.

A comparison was to be made of the value of cottonseed hulls, corn silage, and a combination of these two roughages for fattening steers economically and substantially. As this test was to compare roughages, the same amount of cottonseed meal was fed per head to the steers of all lots. No other concentrate was used.

The same general plan was followed as had been used in former experiments. The cattle were bought in the fall and put on a preliminary feed of cottonseed hulls and meal, and some silage, while confined on a 15-acre pasture until they became thoroughly accustomed to the feeds. They were dehorned during this time and on November 19, 1913, all were tagged, divided into three lots of the same quality and about the same size, weighed individually, and started on their regular experimental rations. They were weighed individually again on the following day, an average taken of the two weights as the initial weight, and the experiment started on the afternoon of November 20.

STEERS USED.

The steers were mostly half and three-quarter breds of Aberdeen-Angus, Shorthorn, Hereford, and Red Polled breeding. They represented one or two crosses of pure-bred beef bulls on the native cows of Alabama. Some of them showed a small amount of Jersey blood also. They averaged about 3 years of age and were of a fair feeder type. They were far superior to the scrub steers of the State, but about the same grade as the steers produced in the prairie section of Alabama and Mississippi.

CHARACTER AND PRICES OF FEEDS USED.

The feeds were all of good quality. The cottonseed meal analyzed 8 per cent ammonia, or about 41 per cent crude protein, and was bright in color. The corn silage was excellent and was made from corn which would have yielded about 35 to 40 bushels of corn per acre.

The feeds were charged at the following prices:

Cottonseed meal	per ton	$27.50
Cottonseed hulls	per ton	9.50
Corn silage	per ton	3.25

The price of cottonseed meal and hulls was the cost delivered to the barn. The cost of the silage was the estimated cost of production and ensiling, including the estimated waste which would occur in making and feeding it.

METHODS OF FEEDING AND HANDLING THE STEERS.

The steers of each of the three lots had an open, unpaved lot for exercise and were fed in troughs under sheds which were planked up on the north and west sides, but open on the other sides. They were furnished water from a 1,300-foot well, and concrete troughs equipped with float valves were located in the lots so that the steers had access to fresh water all the time.

The steers were fed at 7 o'clock in the morning and 5 o'clock in the afternoon. The cottonseed meal was mixed with the roughage in the feed troughs at the time of feeding. The steers were given all the feed they would eat up clean within an hour after feeding.

AVERAGE DAILY RATIONS.

The steers of all three lots were fed the same amount of cottonseed meal each day, as this experiment was conducted for comparing roughages. The cottonseed meal was thoroughly mixed with the roughage at the time of feeding.

Table 1 shows the average daily ration per steer by 28-day periods during the experiment:

TABLE 1.—*Average daily ration per head, by 28-day periods.*

Lot No.	Number of steers.	Ration.	First period.	Second period.	Third period.	Entire period (84 days).
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	20	Cottonseed meal	5.0	6.6	7.2	6.25
		Cottonseed hulls	28.1	29.8	27.7	28.46
2	20	Cottonseed meal	5.0	6.6	7.2	6.25
		Corn silage	39.4	45.3	44.8	43.10
3	20	Cottonseed meal	5.0	6.6	7.2	6.25
		Cottonseed hulls	18.3	19.3	18.6	18.76
		Corn silage	17.4	18.3	17.7	17.77

WEIGHTS AND GAINS OF STEERS.

The following table shows the initial weight of the steers of all lots, the final weights, the total gain per head, and the average daily gain:

TABLE 2.—*Weights and gains of steers (Nov. 20, 1913, to Feb. 12, 1914—84 days).*

Lot No.	Ration.	Average initial weight per steer.	Average final weight per steer.	Average total gains per steer.	Average daily gains per steer.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	Cottonseed meal and cottonseed hulls	837	1,046	209	2.48
2	Cottonseed meal and corn silage	847	1,058	211	2.51
3	Cottonseed meal, cottonseed hulls, and corn silage	819	1,036	217	2.58

The gains made by the steers of all lots were exceedingly satisfactory and indicate that the steers relished their rations and made good use of their feed. The silage-fed steers gained slightly more for the short period than those fed cottonseed hulls. The steers receiving the mixed ration of cottonseed hulls and silage made the greatest gains.

It is a well-known fact that for a short feeding period a ration of cottonseed meal and hulls is a superior feed for fattening steers that are not to be fed over 90 days. The results of this experiment indicate, however, that corn silage as the sole roughage is fully equal to cottonseed hulls for making large daily gains, and it is known that it would have proved much superior for a long feeding period.

QUANTITY AND COST OF FEED REQUIRED TO MAKE 100 POUNDS OF GAIN.

The economy of gains must be considered as well as the size of the gains before drawing any conclusions concerning the value of the two roughages. Knowing the price of feeds and the amount of feed required to make 100 pounds of gain, this can be determined easily. The following table shows the amount of feed required to make 100 pounds of gain and the cost of 100 pounds of gain for each lot of steers:

TABLE 3.—*Quantity and cost of feed required to make 100 pounds of gain. (Nov. 12, 1913, to Feb. 12, 1914—84 days.)*

Lot No.	Ration.	Pounds of feed to make 100 pounds of gain.	Cost of 100 pounds of gain.
1	Cottonseed meal	251	$8.88
	Cottonseed hulls	1,142	
2	Cottonseed meal	248	6.19
	Corn silage	1,711	
3	Cottonseed meal	242	7.89
	One-half cottonseed hulls	727	
	Corn silage	689	

The amount of cottonseed meal required to make 100 pounds of gain varied very little for each of the three lots, ranging from 242 to 251 pounds. The cost of the gain varied greatly, however, there being a difference of $2.69 per 100 pounds between the cost for Lots 1 and 2. The use of cottonseed hulls at $9.50 per ton is usually of very questionable economy and at times is quite unprofitable. Corn silage proved much more economical as a feed at $3.25 per ton.

As 1,711 pounds of corn silage (the amount required to make 100 pounds of gain) proved equal to 1,142 pounds of hulls and three pounds of cottonseed meal, then each ton of silage proved to be worth $6.38 when cottonseed hulls cost $9.50 per ton. This is a very strong argument for using corn silage on the farm, for in Alabama it can usually be grown and put up for about $3 per ton.

FINANCIAL STATEMENT.

The silage was almost exhausted at the end of the third period and it was decided to terminate the experiment, but as the steers were not finished their valuation on the farm was appraised and they were continued on a feed of cottonseed hulls and cottonseed meal for a while longer.

All lots were appraised at the same value, viz, $6.75 per 100 pounds on the farm less 3 per cent shrinkage. The following financial statement has therefore been made for the 84-day feeding experiment:

Financial statement.

Lot 1, cottonseed meal and cottonseed hulls:	
To 20 steers, 16,747 pounds, at $5.25 per hundredweight	$879.21
To 10,510 pounds cottonseed meal at $27.50 per ton	144.51
To 47,823 pounds cottonseed hulls at $9.50 per ton	227.16
Total expenditure	1,250.88
By sale of 20 steers, 20,306 pounds, at $6.75 per hundredweight	1,370.65
Total profit	119.77
Average profit on each steer	5.99
Lot 2, cottonseed meal and corn silage:	
To 20 steers, 16,931 pounds, at $5.25 per hundredweight	888.87
To 10,510 pounds cottonseed meal at $27.50 per ton	144.51
To 72,521 pounds silage at $3.25 per ton	117.85
Total expenditure	1,151.23
By sale of 20 steers, 20,535 pounds, at $6.75 per hundredweight	1,386.11
Total profit	234.88
Average profit per steer	11.74
Lot 3, cottonseed meal, one-half cottonseed hulls, one-half corn silage:	
To 20 steers, 16,390 pounds, at $5.25 per hundredweight	860.47
To 10,510 pounds cottonseed meal at $27.50 per ton	144.51
To 31,520 pounds cottonseed hulls at $9.50 per ton	149.72
To 27,861 pounds silage at $3.25 per ton	48.52
Total expenditure	1,203.22
By sale of 20 steers, 20,103 pounds, at $6.75 hundredweight	1,356.95
Total profit	153.73
Average profit per steer	7.69

The steers of all lots cost $5.25 per hundredweight in the fall. At the end of the feeding period they were appraised at $6.75 per 100 pounds, or a margin of $1.50 per hundredweight was received for all. No charge is made for labor and no credit is given for the manure produced.

The silage-fed steers were by far the most profitable. The steers of Lot 1, which received cottonseed hulls as the sole roughage, made the smallest profits. When the prices of feeds are considered the steers of all lots made exceedingly satisfactory profits.

SUMMARY OF THE EXPERIMENT.

1. The object of this experiment was to study the relative efficiency of cottonseed hulls, corn silage, and a combination of these two roughages when fed with cottonseed meal for finishing steers during a short feeding period.

2. The steers used were mostly 3-year-olds showing a predominance of blood of the various beef breeds, and averaged 834 pounds per head at the beginning of the test. They were divided into three lots of 20 each and fed 84 days during the winter.

3. The steers of Lot 1 were fed a ration of cottonseed meal and cottonseed hulls; those of Lot 2 received a ration of cottonseed meal and corn silage; while those of Lot 3 were given cottonseed meal, cottonseed hulls, and corn silage.

4. During the 84-day feeding period the average daily gain per head was 2.48 pounds, 2.51 pounds, and 2.58 pounds, respectively, for the steers of Lots 1, 2, and 3.

5. It cost $8.88 to produce 100 pounds of gain in Lot 1, $6.19 in Lot 2, and $7.89 in Lot 3.

6. The net profits per head amounted to $5.99, $11.74, and $7.69 for the steers of Lots 1, 2, and 3, respectively.

7. The experiment shows very clearly the superiority of corn silage over cottonseed hulls as a roughage for fattening steers.

II. A COMPARISON OF THE VALUE OF COTTONSEED HULLS, CORN SILAGE, AND A COMBINATION OF COTTONSEED HULLS AND CORN SILAGE FOR FATTENING STEERS (MISSISSIPPI EXPERIMENT).

INTRODUCTION.

The results of the cooperative experiment between the Bureau of Animal Industry and the Alabama Experiment Station, reported in Part I of this bulletin, were very satisfactory in every way, but following the policy of the bureau in all experimental work it was decided to duplicate the experiment before publishing the results, as conditions under which a feeding test is conducted vary greatly from year to year, due to climatic conditions, variations in the feed used, conditions of feed lots, fluctuations in the buying and selling prices of cattle, feed, etc. As the cooperative cattle-feeding work was transferred from Alabama to Mississippi before the test could be duplicated, it was decided to conduct another test in Mississippi under conditions as nearly similar as possible.

There are a few points which should be borne in mind in comparing the results of the two tests in order to do the work justice in each case, namely, (1) The steers used in each test were of almost the same grade and breeding, but the Alabama steers were a little better in quality. (2) Good bright cottonseed meal and cottonseed hulls of the same grade were used for both experiments and were therefore similar. (3) The corn silage used in the Alabama test was excellent, having a large amount of grain in it and keeping splendidly, but owing to a bad season for corn the silage used in the Mississippi experiment was much below the average, as it had very little grain in it and did not keep so well as it should. (4) The feeding pens became muddy each winter, but the sheds used in the Alabama experiment were kept well bedded, while in the Mississippi test after the sixth week bedding was very scarce and the feeding pens became very deep in mud, the steers having no choice but to lie in the deep mud. (5) The Alabama test covered a period of 84 days, while the steers in this experiment were fed 143 days.

OBJECT AND PLAN OF THE WORK.

This test was to be a duplication of the feeding experiment reported in Part I of this bulletin, namely, a study of the compara-

tive value of cottonseed hulls, corn silage, and a combination of cottonseed hulls and corn silage for fattening steers, with cottonseed meal as the sole concentrate.

The steers were bought in the fall and started on a preliminary feed of cottonseed meal and cottonseed hulls on October 8, 1914. On October 25 corn silage was introduced in the ration and the feeding continued until November 12, when the steers were divided into three lots and started in the regular feeding experiment on November 13.

The work was conducted upon the farm of Mr. Ben Walker, of Abbott, Miss. Mr. Walker furnished the cattle, the feeds, and all equipment except such things as feed baskets, small scales, etc., which were furnished by the Mississippi experiment station. The bureau placed Mr. N. F. Hanson upon the farm to conduct the experiment, and his entire time was devoted to the work.

CATTLE USED.

The steers were grades of the various beef breeds and ranged from one-half to three-quarters pure. They were from $2\frac{1}{2}$ to $3\frac{1}{2}$ years of age, but were fairly uniform in size. They were not quite so good in quality as the Alabama steers. The steers were such as may be found anywhere in the South where one or two crosses of pure-bred beef bulls have been made on the native cows. All of them were raised in the neighborhood of Abbott, Miss. All were tick free and had been so for more than a year.

CHARACTER AND PRICE OF FEEDS.

The cottonseed meal was bright, and analysis showed a crude protein content of about 38 per cent. The hulls were of average quality. The corn silage was below the average in quality, as it contained very little grain and was somewhat dry when put into the silo. The cottonseed meal and hulls were contracted for in the early summer and purchased cheap. The cottonseed meal cost $23.50 per ton and the hulls $6.50 per ton. They are charged at actual cost in this test. Corn silage was charged at $3 per ton.

METHODS OF FEEDING AND HANDLING THE CATTLE.

The steers which had horns were dehorned during the preliminary feeding period, and each was numbered by means of a tag on a leather neckstrap. The steers were divided into three similar lots and weighed individually on November 12 and 13, and an average of the two weights taken as the initial weight. The steers were

weighed each 28 days and were again weighed individually at the end of the experiment.

All three lots were fed in a large barn, but the feeding pens were so arranged as to give the cattle the run of lots outside the barn. Water troughs were in each pen, and a deep well furnished fresh water at all times. The feeds were placed in stationary feed troughs, the cottonseed meal being thoroughly mixed with the roughage at the time of feeding. The steers were fed all the roughage they would eat up clean within one hour after feeding. The feeding was done at 7 a. m. and 3.30 p. m. each day. Rock salt was kept in the feed troughs at all times.

Enough bedding, consisting of shavings, waste straw, and cornstalks, was used during the first six weeks to keep the animals very comfortable. After that time bedding was scarce, and the prairie roads were in such condition that it could not be obtained; as a result the pens became very muddy. Some rotten limerock was placed around the feed and water troughs to make a firm standing place but the urine caused the rock to disintegrate in a few days, leaving the pens in worse condition than before. Although some manure was taken out, all the pens remained deep in mud until the close of the experiment. The relatively small daily gains made by all the steers can be attributed largely to the condition of the pens and the absence of open lots. There were 25 steers in Lot 1 and 26 in each of the other two lots.

AVERAGE DAILY RATIONS.

The object of the work being to compare the roughage rations, the steers of all three lots were fed the same amount of cottonseed meal per head per day throughout the experiment. Table 4 shows the average daily ration of the steers of each lot by 28-day periods.

TABLE 4.—*Average daily ration per head by 28-day periods. (Nov. 13, 1914 to April 5, 1915—143 days.)*

Lot No.	Number of steers.	Ration.	First period.	Second period.	Third period.	Fourth period.	Fifth period (31 days).	Entire period (143 days).
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	25	Cottonseed meal	4.7	5.5	5.9	6.5	6.7	5.90
		Cottonseed hulls	25.2	22.2	25.6	24.9	23.2	24.12
2	26	Cottonseed meal	4.7	5.5	5.9	6.5	6.7	5.90
		Corn silage	38.1	42.2	45.2	43.5	43.5	42.89
3	26	Cottonseed meal	4.8	5.5	5.9	6.5	6.7	5.90
		Cottonseed hulls	10.7	11.4	12.6	11.7	11.9	11.68
		Corn silage	26.4	26.6	29.4	27.6	29.2	27.98

Each steer was fed an average of about $4\frac{3}{4}$ pounds of cottonseed meal per day during the first 28-day period. The amount was gradu-

ally increased until the last period, when each steer consumed practically 6¾ pounds of meal a day. All the roughage was fed which the steers would clean up within one hour after feeding. The amount consumed by Lots 2 and 3 remained fairly constant for the entire experiment. The steers of Lot 1 did not consume quite as much cottonseed hulls the last two months as they did before that time. For the entire period of 143 days each steer of Lot 1 consumed on the average 24.12 pounds of cottonseed hulls daily; each steer in Lot 2 ate 42.89 pounds of corn silage; and each steer of Lot 3 was fed an average of 11.68 pounds of cottonseed hulls and practically 28 pounds of corn silage per day.

WEIGHTS AND GAINS.

The following table shows the initial weight, the final weight, the total gain, and the average daily gain per steer for all three lots:

TABLE 5.—*Weights and gains.* (*Nov. 13, 1914, to Apr. 5, 1915—143 days.*)

Lot No.	Ration.	Average initial weight per steer.	Average final weight per steer.	Average total gain per steer.	Average daily gain per steer.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	Cottonseed meal and cottonseed hulls	814	1,012	198	1.38
2	Cottonseed meal and corn silage	812	976	164	1.15
3	Cottonseed meal, cottonseed hulls, and corn silage	814	1,054	240	1.67

The average initial weight of the steers in each lot was very uniform, being 814, 812, and 814 pounds, respectively, for the steers of Lots 1, 2, and 3. The steers did not gain as much as they should during the experiment. The fact that the pens were deep in mud during most of the time had considerable to do with the amount of gains made and emphasizes the importance of having dry and comfortable beds for fattening steers. In the black-prairie section of Mississippi and Alabama, where the ground tramps into deep mud very easily, it is essential that the steers have either dry beds under shelter, or paved lots, or a combination of both.

The fact that the silage was of poor quality this year was reflected in the average daily gains made by the steers. The silage was practically of the same character as that which would be made by pulling all the ears from the corn and running the stalks alone into the silo. During the previous year the steers which were fed a ration of good silage and had comfortable beds made an average daily gain of 2.51 pounds per head per day for 84 days, while the steers in this test made less than 1¼ pounds per day for 143 days.

QUANTITY AND COST OF FEED REQUIRED TO MAKE 100 POUNDS OF GAIN.

The following table shows the amount and cost of feed required to make 100 pounds of gain for each lot:

TABLE 6.—*Quantity and cost of feed required to make 100 pounds of gain (Nov. 13, 1914, to Apr. 5, 1915—143 days).*

Lot No.	Ration.	Pounds of feed to make 100 pounds of gain.	Cost of 100 pounds of gain.
1	Cottonseed meal	427	$10.70
	Cottonseed hulls	1,749	
2	Cottonseed meal	515	11.26
	Corn silage	3,745	
3	Cottonseed meal	352	8.90
	Cottonseed hulls	697	
	Corn silage	1,668	

The steers which received a combination of cottonseed hulls and corn silage for their roughage utilized their feed better than the steers in either of the other lots, as a considerably smaller amount of cottonseed meal was required to make 100 pounds of gain.

The following prices were charged for feeds in this test:

Cottonseed meal, per ton	$23.50
Cottonseed hulls, per ton	6.50
Corn silage, per ton	3.00

The price of cottonseed meal was less than normal, as the meal was contracted for in the summer, when the price was low. The price of cottonseed hulls was relatively cheap for that year, while the price charged for corn silage was about as much as it was worth. It probably cost about $3 per ton to grow and prepare this silage for feeding. With a reasonably good season the silage would have been much higher in quality and probably would have cost somewhat less per ton, due to the increased tonnage per acre. With feeds at these prices the cost of 100 pounds of gain for the entire period was $10.70, $11.26, and $8.90 for Lots 1, 2, and 3, respectively.

FINANCIAL STATEMENT.

The steers which were used in this experiment had been bought in the fall, and put on a preliminary feed from October 8 to November 12, at which time the experiment was started. The original cost of the steers, plus the cost of feed during the preliminary period, was divided by the initial weight of the steers to get the price per 100 pounds. This amounted to an average price of $5.47 per hundredweight for the entire bunch of steers. They are charged at that

price. The price of feeds has already been stated. The steers were shipped from Abbott, Miss., to the St. Louis market. The freight on the cattle to market was $63 per car or per lot, and the charges for commission, yardage, feed, insurance, etc. totaled $24 per lot.

Financial statement.

Lot 1, cottonseed meal and cottonseed hulls:	
To 25 steers, 20,345 pounds, at $5.47 per hundredweight	$1,112.87
To 21,098 pounds cottonseed meal, at $23.50 per ton	247.90
To 86,508 pounds cottonseed hulls, at $6.50 per ton	281.35
To freight on one car of 25 steers	63.00
To commission, yardage, feed, insurance, etc	24.00
Total expenditure	1,729.12
By sale of 23 steers, 21,800 pounds, at $7.45 per hundredweight	1,729.12
By sale of 1 steer, 800 pounds, at $6.50 per hundredweight	52.00
By sale of 1 steer, 930 pounds, at $5.40 per hundredweight	50.22
Total sale of Lot 1	1,688.52
Total loss	40.60
Average loss per head	1.62
Lot 2, cottonseed meal and corn silage:	
To 26 steers, 21,125 pounds, at $5.47 per hundredweight	1,155.54
To 21,952 pounds cottonseed meal, at $23.50 per ton	257.94
To 159,494 pounds corn silage, at $3 per ton	239.24
To freight on car of 26 steers	63.00
To commission, yardage, feed, insurance, etc	24.00
Total expenditure	1,739.72
By sale of 26 steers, 24,810 pounds, at $7.25 per hundredweight	1,798.72
Total profit	59.00
Average profit per steer	2.27
Lot 3, cottonseed meal, cottonseed hulls, and corn silage:	
To 26 steers, 21,172 pounds, at $5.47 per hundredweight	1,158.11
To 21,952 pounds cottonseed meal, at $23.50 per ton	257.94
To 43,451 pounds cottonseed hulls, at $6.50 per ton	141.21
To 104,039 pounds corn silage, at $3 per ton	156.09
To freight on car of 26 steers	63.00
To commission, yardage, feed, insurance, etc	24.00
Total expenditure	1,800.35
By sale of 26 steers, 25,420 pounds, at $7.30 per hundredweight	1,855.66
Total profit	55.31
Average profit per steer	2.13

The total expenditure for Lot 1 was $1,729.12, while the selling price of the cattle was $1,688.52, showing a loss of $40.60 on the lot or an average loss of $1.62 per head. The steers of Lot 2, which received cottonseed meal and corn silage, made a net profit of $59 for the lot, or an average profit of $2.27 per steer. It is seen that although the silage-fed steers did not make as big daily gains as the steers fed on cottonseed hulls, they sold for a higher price on the

market. This was due to finishing more uniformly and having better coats than the cattle fed on cottonseed hulls and meal. The steers of Lot 3, which made the largest gains of all the lots, sold for 5 cents more per hundredweight than the steers of Lot 2, and made a profit of $55.31 on the lot, or an average profit of $2.13 per head.

The feeding of cottonseed hulls and meal in this experiment was unprofitable, whereas the feeding of corn silage or a combination of corn silage and cottonseed hulls with cottonseed meal as a concentrate was profitable. The steers of both Lots 2 and 3, as a whole, showed more uniformity of finish than the steers of Lot 1, although some of the latter had gained exceedingly well and had finished out well. This is frequently the case when cottonseed hulls and meal are fed. Cattle fed on these feeds seldom finish out as uniformly as cattle which receive silage as a roughage. The steers were sold on a rather poor market, and if they could have been held three weeks longer they would have brought considerably more money and showed quite a nice profit. When all things are considered, the results of the test were satisfactory and tend to emphasize the importance of corn silage as a roughage for finishing steers for the market.

SLAUGHTER DATA.

In Table 7 are shown the results of the shipping and slaughtering of the steers in this experiment:

TABLE 7.—*Slaughter data.*

Lot No.	Ration.	Average farm weight per steer.[1]	Average market weight per steer.	Average shrinkage in transit.	Average weight of carcass.	Per cent dressed.	
						By farm weights.	By market weights.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*
1	Cottonseed meal and cottonseed hulls	996	944	52	531.6	53.40	56.27
2	Cottonseed meal and corn silage	1,017	954	63	557.4	54.81	58.41
3	Cottonseed meal, cottonseed hulls, and corn silage	1,033	978	55	566.8	54.85	57.97

[1] The final farm weights were taken April 11, six days after conclusion of the experiment; the market weights were taken three days later, April 14.

The steers were driven from the feed lots to West Point, Miss., a distance of 12 miles, to be loaded on the cars. As they had to travel over a gravel road, some of them began getting tender footed before reaching the pens. They arrived at the loading pens in the afternoon, where they were given hay and had access to water, and were loaded the following morning. They were in transit 24 hours, and were sold and slaughtered the same day that they reached the market.

The dressing percentages show that the steers of both Lots 2 and 3 were finished somewhat better than the steers of Lot 1. The per-

centages are all satisfactory, and th e purchaser reports that the steers of all lots showed extra nice carcasses and that he was well pleased with the way they dressed out.

SUMMARY OF THE EXPERIMENT.

1. This experiment was a duplication of the Alabama test reported in Part I of this bulletin as to the relative efficiency of cottonseed hulls, corn silage, and a combination of the two when fed with cottonseed meal for fattening steers.

2. The steers used were grades of the various beef breeds, averaging 813 pounds per head at the beginning of the experiment. The 77 steers were divided into three lots and fed 143 days during the winter of 1914–15.

3. Cottonseed meal was fed in equal quantities to all the steers. In addition to this the steers in Lot 1 were fed cottonseed hulls, those in Lot 2 corn silage, and those in Lot 3 both cottonseed hulls and corn silage.

4. For the entire feeding period of 143 days the steers of Lots 1, 2, and 3 made an average daily gain per head of 1.38, 1.15, and 1.67 pounds, respectively. These daily gains are noticeably smaller than those made in the Alabama test the previous winter. This is due chiefly to slightly inferior steers, poor silage, less desirable feeding conditions, and a longer feeding period in the 1914–15 trial.

5. The cost to make 100 pounds of gain was $10.70 for Lot 1; $11.26 for Lot 2, and $8.90 for Lot 3.

6. The steers of Lot 1 were marketed at an average loss of $1.62 per head, but those of Lots 2 and 3 returned an average net profit of $2.27 and $2.13 per head, respectively. Notwithstanding the fact that the prices of feeds were less and the steers were sold at a greater margin in the 1914–15 trials, the three lots of steers fed the previous year in Alabama made considerably more profit. The high cost of gains in 1914–15 had offset the advantages of cheap feeds and more favorable marketing.

7. The shrinkage per head in transit to market was 51 pounds for Lot 1, 63 pounds for Lot 2, and 56 pounds for Lot 3. The silage-fed steers shrank a little more in transit than the steers of Lot 1.

8. The dressing percentages were 56.27, 58.41, and 57.97 for Lots 1, 2, and 3, respectively.

9. While the steers of Lot 1, which were fed cottonseed hulls as roughage, made slightly larger daily gains and less expensive gains than the steers of Lot 2, which received a poor grade of silage, the steers of Lot 2 made a greater profit and dressed out a higher percentage of marketable meat.

III. A COMPARISON OF SOME COMMON FARM-GROWN ROUGHAGES FOR FATTENING STEERS (EXPERIMENT OF 1915–16.)

INTRODUCTION.

This experiment was conducted on the Canton Stock Farm, located in the "Brown loam" section of Mississippi, near the town of Canton, in Madison County. The work was conducted during the winter of 1915–16 under the same general plan under which the other cooperative work was conducted and does not need explaining here. Mr. S. S. Jerdan, who had been employed for three years previously in conducting such experiments, was located on the farm and closely supervised the weighing of all feeds and the feeding. His entire time was devoted to this and some other experimental work being done on the farm.

OBJECT AND PLAN OF THE WORK.

Many feeders have claimed that when silage is fed to steers they should have a small amount of dry roughage in addition, and that it would be more economical and satisfactory to feed a small amount of roughage with the silage than to feed silage alone. It has been claimed also that this is especially desirable when no other concentrate than cottonseed meal is fed.

This experiment was planned and conducted to determine whether these statements were true. Three lots of steers were used for this comparison, and a fourth lot was fed to see what such common southern feeds as cowpea hay, oat straw, and corn stover would give satisfactory returns if they were fed in equal parts to fattening steers.

CATTLE USED.

The 80 steers used in this experiment were grades ranging from one-half to seven-eighths pure-bred of the various beef breeds—Shorthorn, Hereford, Aberdeen-Angus, Red Poll, and Devon. In age they ranged from 2 to 4 years.

All the steers were bought in Madison County, Miss., and were better than the average steers found in that section. They averaged 787 pounds in weight when placed in the experiment.

CHARACTER AND PRICES OF FEEDS USED.

The steers were divided into 4 lots of 20 each. Lot 1 was fed cottonseed meal and sorghum silage. Lot 2 received cottonseed meal, sorghum silage, and corn stover. Lot 3 received cottonseed meal, sorghum silage, and oat straw. Lot 4 received cottonseed cake, cowpea hay, oat straw, and corn stover.

The meal and cake used in the test had a crude-protein analysis of 41 per cent. Both were bright and of good quality. The cake was cracked to nut size. The silage was made of a rank-growth sorghum and was very good. The cowpea hay was of good quality; most of it carried lots of peas, and it was nicely cured. The corn stover was fairly bright and as good as the average stover found in the South. Oat straw that had been baled immediately after thrashing was used; it was clean and bright.

The prices used in charging the different feeds were as follows:

Cottonseed meal	per ton	$32
Sorghum silage	do	3
Cowpea hay	do	10
Corn stover	do	5
Oat straw	do	5

METHOD OF FEEDING AND HANDLING THE CATTLE.

The lots in which the steers were fed varied somewhat in size. Lots 1, 2, and 3 were fed in stationary troughs which were located under sheds, which opened on the south and west sides. Lot 4 was fed from a trough which was in the open.

Water was furnished to each lot in large galvanized-iron troughs kept filled from a deep well.

The steers were fed at 7 a. m. and 5 p. m. Each of the first three lots were fed cottonseed meal and silage twice a day. The hay and stover were fed once a day. The silage was limited to the amount they would clean up in one hour.

All the steers were dehorned about two weeks before going into the experiment. About this time they were placed on a preliminary feed of cottonseed meal and sorghum silage. The cattle were tagged and on November 26 and 27 were weighed individually, the average of the two weights being used as the initial weight.

During the progress of the experiment the steers were weighed by lots at the end of each 28-day period. At the end of the experiment the steers were weighed individually on three successive days, and the average of these weights was used as the final weight.

AVERAGE DAILY RATIONS.

The average daily ration per steer by 28-day periods and the average ration for the entire period of 127 days is shown in the following table:

TABLE 8.—*Average daily ration per head by 28-day periods.*

Lot No.	Number of steers.	Feeds.	First period.	Second period.	Third period.	Fourth period.	Fifth period. (15 days).	Entire period (127 days).
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	20	Cottonseed meal	4.1	5.8	6.9	7.0	7.0	6.1
		Sorghum silage	40.5	46.0	41.0	42.7	40.8	42.4
2	20	Cottonsead meal	4.1	5.8	6.9	7.0	7.0	6.1
		Sorghum silage	36.0	41.1	37.7	38.7	39.5	38.6
		Corn stover	3.7	3.0	2.4	1.5	0.8	2.5
3	20	Cottonseed meal	4.1	5.8	6.9	7.0	7.0	6.1
		Sorghum silage	36.3	41.0	37.8	38.8	39.0	38.6
		Oat straw	3.5	1.7	2.3	0.9	0.8	1.9
		Cottonseed cake	4.1	5.8	6.9	7.0	7.0	6.1
4	20	Cowpea hay	7.7	7.9	8.9	7.8	7.4	8.0
		Oat straw	7.7	7.9	8.9	7.8	7.4	8.0
		Corn stover	7.7	7.9	8.9	7.8	7.4	8.0

The steers of all four lots were fed cottonseed meal as the sole concentrate. As all the steers were of about the same size, and as a comparison of roughages was to be made, the steers of the various lots received the same amount of cottonseed meal each day. For the first 28-day period the steers of all lots were fed 4.1 pounds of cottonseed meal each per day. The amount of cottonseed meal was gradually increased so that all steers received an average of 5.8 pounds per head the second period, 6.9 pounds the third period, and 7 pounds per head per day during the fourth and fifth periods. The average amount of cottonseed meal consumed daily by each steer for the entire period of 127 days was 6.1 pounds.

The steers of Lot 1, which received sorghum silage as the sole roughage, consumed 40.5 pounds per head daily. Each steer in Lot 2 consumed 36 pounds of silage and 3.7 pounds of corn stover, while each one in Lot 3 ate 36.3 pounds of silage and 3.5 pounds of oat straw. The average daily ration of roughage per steer in Lot 4 was 7.7 pounds each of the following: Cowpea hay, oat straw, and corn stover.

The steers of Lot 1 ate 46 pounds of silage per head daily during the second period, but this amount decreased for the subsequent periods. Each steer fed silage as the sole roughage consumed an average of 42.4 pounds per day for the entire 127-day period.

The steers of Lot 2, which were fed silage with what corn stover they would eat, consumed 41.1 pounds of silage and 3 pounds of corn stover per head daily for the second period. During subsequent periods they ate somewhat less silage and stover. During the last two periods the steers did not seem to care much for the stover and

consumed an average of but a little more than 1 pound per head daily.

The steers of Lot 3, which were fed all the silage they would eat and had access to good oat straw, consumed 41 pounds of silage and 1.7 pounds of oat straw per day during the second period and somewhat less roughage during the subsequent periods, eating less than 1 pound of oat straw per head daily during the last two periods.

These rations indicate that while steers which are being fed silage will eat a little dry roughage if placed before them, the amount is small if the silage is palatable and the amount of roughage becomes almost a negligible factor during the latter part of the feeding period. The steers which ate some roughage did not eat so much silage. For the entire period of 127 days the steers of Lots 2 and 3 ate exactly the same amount of silage, namely, 38.6 pounds per head per day, and in addition consumed 2.5 and 1.9 pounds of stover and oat straw, respectively, each day. The steers of Lot 1, which received silage alone, consumed on the average 3.8 pounds more silage per head per day than the steers of Lot 2, or, in other words, 2.5 pounds of corn stover or 1.9 pounds of oat straw replaced 3.8 pounds of sorghum silage in the ration.

WEIGHTS AND GAINS.

The following table shows the average initial and final weights per steer of each lot and the total and average daily gains per steer:

TABLE 9.—*Weights and gains (Nov. 26, 1915, to Apr. 1, 1916—127 days).*

Lot No.	Ration.	Average initial weight per steer.	Average final weight per steer.	Average total gain per steer.	Average daily gain per steer.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	Cottonseed meal and sorghum silage	787	1,058	272	2.14
2	Cottonseed meal, sorghum silage, and corn stover	788	1,036	248	1.95
3	Cottonseed meal, sorghum silage, and oat straw	790	1,030	240	1.89
4	Cottonseed cake, cowpea hay, oat straw, and corn stover	787	989	202	1.59

The steers of all lots were nearly uniform in size at the beginning of the experiment, the greatest average variation in weight per steer of any lot being 3 pounds. The final average weight of the steers of Lot 1 was 1,058 pounds; Lot 2, 1,036 pounds; Lot 3, 1,030 pounds; and Lot 4, 989 pounds.

The average gain in weight per steer for Lot 1 was 272 pounds for 127 days, or an average daily gain of 2.14 pounds, which is exceedingly satisfactory. Each steer of Lot 2, which had a small amount of corn stover in addition to the sorghum silage, gained 1.95 pounds daily, while those of Lot 3, which had a supplemental ration of oat straw, gained but 1.89 pounds daily. The steers of Lot 4, which were

fed a dry-roughage ration of cowpea hay, oat straw, and corn stover, gained only 1.59 pounds per head per day.

The use of a small amount of dry roughage fed with good sorghum silage failed to cause the steers to make larger daily gains; in fact, it had just the opposite effect. The steers receiving silage alone consumed a larger amount daily and made larger daily gains. A roughage ration composed of one-third cowpea hay, one-third oat straw, and one-third corn stover did not prove satisfactory for fattening steers when cottonseed cake was the sole concentrate fed.

QUANTITY AND COST OF FEED REQUIRED TO MAKE 100 POUNDS OF GAIN.

The following table shows the amount and cost of feeds required to make 100 pounds of gain:

TABLE 10.—*Quantity and cost of feed required to make 100 pounds of gain. (November 26, 1915, to April 1, 1916—127 days.)*

Lot No.	Ration.	Pounds of feed to make 100 pounds of gain.	Cost of 100 pounds of gain.
1	Cottonseed meal	284	$7.52
	Sorghum silage	1,978	
2	Cottonseed meal	312	8.26
	Sorghum silage	1,976	
	Corn stover	125	
3	Cottonseed meal	322	8.47
	Sorghum silage	2,041	
	Oat straw	103	
4	Cottonseed meal	383	11.16
	Cowpea hay	504	
	Oat straw	504	
	Corn stover	504	

Lot 1, which was fed on a ration of cottonseed meal and sorghum silage, required 284 pounds of cottonseed meal and 1,978 pounds of silage to make 100 pounds of gain. Each 100 pounds of gain was made at a cost of $7.52. The cost of producing the gains on this lot was lower than for any of the other lots.

Lot 4 received 383 pounds of cottonseed meal and 504 pounds each of oat straw, corn stover, and cowpea hay per 100 pounds gain. The gains in this lot were made at a cost of $11.16. The steers in this lot not only made the smallest gains of all the lots, but the gains were the most expensive. The small gains, which are accounted for by the lack of succulence and palatability in the roughage ration, are responsible for the high cost of gains.

The rate of gains as well as the cost of gains in this experiment seems to indicate that the addition of such roughages as corn stover or oat straw do not add to the value of a silage ration when the silage is made of well-matured sorghum. The outcome of Lot 4 in this experiment emphasizes the value of silage in the fattening ration

and that a ration containing so much cheap roughage as stover and oat straw is not well adapted for fattening cattle. It could probably be used to better advantage for wintering feeder and stocker cattle.

FINANCIAL STATEMENT.

The following table gives a financial statement of the purchase, feeding, transportation, and sale of each of the four lots of steers:

Financial statement.

Lot 1, cottonseed meal and sorghum silage:	
To 20 steers, 15,734 pounds, at $5 per hundredweight	$786.70
To 15,455 pounds cottonseed meal at $32 per ton	247.28
To 107,627 pounds silage at $3 per ton	161.44
To freight, yardage, commission, feed, etc.	104.08
Total expenditure	1,299.50
By sale of 20 steers, 19,333 pounds, at $8.45 per hundredweight	1,633.64
Total profit	334.14
Average profit per steer	16.71
Lot 2, cottonseed meal, sorghum silage, and corn stover:	
To 20 steers, 15,718 pounds, at $5 per hundred weight	785.90
To 15,455 pounds cottonseed meal, at $32 per ton	247.28
To 98,014 pounds silage, at $3 per ton	147.02
To 6,233 pounds corn stover, at $5 per ton	15.58
To freight, yardage, commission, feed, etc.	104.08
Total expenditure	1,299.86
By sale of 20 steers, 18,870 pounds, at $8.45 per hundredweight	1,594.51
Total profit	294.65
Average profit per steer	14.73
Lot 3, cottonseed meal, sorghum silage, and oat straw:	
To 20 steers, 15,808 pounds, at $5 per hundredweight	790.40
To 15,455 pounds cottonseed meal, at $32 per ton	247.28
To 97,964 pounds silage, at $3 per ton	146.95
To 4,935 pounds oat straw, at $5 per ton	12.34
To freight, yardage, commission, feed, etc.	104.08
Total expenditure	1,301.05
By sale of 20 steers, 18,900 pounds, at $8.45 per hundredweight	1,597.05
Total profit	296.00
Average profit per steer	14.80
Lot 4, cottonseed meal, oat straw, corn stover, and cowpea hay:	
To 20 steers, 15,735 pounds, at $5 per hundredweight	786.75
To 15,455 pounds cottonseed meal, at $32 per ton	247.28
To 20,387 pounds straw, at $5 per ton	50.97
To 20,387 pounds corn stover, at $5 per ton	50.97
To 20,387 pounds hay, at $10 per ton	101.93
To freight, yardage, commission, feed, etc.	104.08
Total expenditure	1,342.98
By sale of 20 steers, 18,020 pounds, at $8.17 per hundredweight	1,472.23
Total profit	129.25
Average profit per steer	6.46

The steers used in this test were purchased at an average cost of $5 per 100 pounds. After 127 days of feeding the steers of each of the first three lots sold on the St. Louis market for $8.45 per 100 pounds. The steers of Lot 4 brought but $8.17 per hundredweight, as they were not so well finished. The margin between the purchase and the sale price of the steers was exceptionally high. The costs of gains were low and this factor combined with the wide margin tended toward the high profit which was realized on the different lots. Lot 1, which received cottonseed meal and corn silage, showed the greatest profit, and Lot 4 showed the least profit.

SLAUGHTER DATA.

On April 2 the steers were driven 2 miles to Canton, Miss., from which place they were shipped to the St. Louis market. During the 24 hours prior to this they were given only bright oat straw to eat, but were allowed all the water they wished to drink. They were loaded on the cars at 10 a. m., April 2. At 4 p. m., April 4 they arrive in the stockyards at East St. Louis, being in transit 56 hours, which was unusually long for this run. Upon arrival at market they were fed and watered. They were sold the morning of April 5, after taking only a fair fill.

The following table gives the slaughter data for each of the lots:

TABLE 11.—*Slaughter data.*

Lot No.	Ration.	Average farm weight per steer.	Average market weight per steer.	Average shrinkage in transit.		Average weight of carcass.	Per cent dressed.	
							By farm weights.	By market weights.
		Pounds.	*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*	*Per cent.*
1	Cottonseed meal and sorghum silage	1,058	966	92	8.69	549	51.88	56.82
2	Cottonseed meal, sorghum silage, and corn stover	1,036	943	93	8.97	537	51.81	56.92
3	Cottonseed meal, sorghum silage, and oat straw	1,030	945	85	8.25	532	51.65	56.29
4	Cottonseed meal, oat straw, cowpea hay, and corn stover	989	901	88	8.89	491	49.65	54.51

The average shrinkage per head for each lot was as follows: Lot 1, 92 pounds; Lot 2, 93 pounds; Lot 3, 85 pounds; Lot 4, 88 pounds. Lot 3, which received oat straw in addition to cottonseed meal and corn silage, showed the least shrinkage. The shrinkage was more than normal on all lots, probably due to the length of time in transit.

The carcasses were all good, being nicely covered with fat. The dressing percentages of the first three lots were very uniform. The

steers of Lot 4 were not so fat as the silage-fed steers, as shown by the dressing percentages; the steers of Lot 4 dressing out almost 2 per cent less than the steers of the other lots.

SUMMARY OF THE EXPERIMENT.

1. The objects of this experiment were: (*a*) to determine whether it is more profitable to feed silage as the sole roughage ration or to supplement it with a small amount of dry roughage, such as corn stover or oat straw, and (*b*) to determine the value of a combination of such common southern roughage as cowpea hay, oat straw, and corn stover for fattening steers.

2. The steers used in this experiment were grade native steers, ranging from one-half to seven-eighths pure-bred Shorthorn, Aberdeen-Angus, Hereford, Red Poll, and Devon. They were above the average of steers found in that section and ranged in age from 2 to 4 years.

3. The steers were divided into 4 lots of 20 each and fed for a period of 127 days. Lot 1 was fed cottonseed meal and sorghum silage; Lot 2 received cottonseed meal, sorghum silage, and corn stover; Lot 3 received cottonseed meal, sorghum silage, and oat straw; Lot 4 was fed cottonseed cake, cowpea hay, oat straw, and corn stover.

4. Lot 2 started with a daily average consumption of 3.7 pounds of stover per head, decreasing to 0.6 pound in the last period. Lot 3 commenced with a daily average consumption of 3.5 pounds of oat straw per head, decreasing to 0.8 pound in the last period. These rations indicate that while steers being fed silage will eat a little dry roughage if placed before them, the amount is small if the silage is palatable, and becomes an almost negligible factor during the latter part of the feeding period. The steers which ate some roughage did not eat so much silage.

5. The average daily gains per head for the period of 127 days were 2.14, 1.95, 1.89, and 1.59 pounds, for Lots 1, 2, 3, and 4, respectively. The use of a small amount of dry roughage fed with good sorghum silage failed to cause the steers to make larger gains; in fact, it had just the opposite effect. The steers receiving silage alone consumed a larger amount daily and made larger daily gains.

6. A roughage ration consisting of one-third cowpea hay, one-third oat straw, and one-third corn stover did not prove so satisfactory for fattening steers when cottonseed cake was the sole concentrate fed.

7. The total cost of 100 pounds gain was $7.52, $8.26, $8.47, and $11.16 for lots 1, 2, 3, and 4, respectively. The rate of gains, as well as the cost of gains in the experiment, seems to indicate that the addition of such roughages as oat straw and corn stover do not add to the value of a silage ration.

8. The outcome of Lot 4 emphasizes the value of silage for fattening cattle and indicates that such cheap roughage is not adapted for the purpose. It probably could be used to better advantage for wintering feeder and stocker cattle.

9. The profit per head in Lot 1 was $16.71; Lot 2, $14.73; Lot 3, $14.80, and Lot 4, $6.46. The exceptionally high margin combined with the low cost of gains tended toward the high profits realized in the various lots.

10. Lot 4 was not so well finished and brought a lower market price.

IV. A COMPARISON OF SOME COMMON FARM-GROWN ROUGHAGES FOR FATTENING STEERS (EXPERIMENT OF 1916–17).

INTRODUCTION.

This test, conducted on the Canton Stock Farm at Canton, Miss., is a duplication of the work at the same station the previous year. As before, Mr. S. S. Jerdan had charge of the work, and the test was carried out under the same general conditions as the experiments of previous years. Owing to a lack of cowpea hay, it was not possible to feed a lot of steers as Lot 4 had been fed in the winter of 1915–16.

OBJECT AND PLAN OF THE WORK.

The objects were identical with those stated under Part III and serve to furnish a check or certification of the results obtained in the test of 1915–16.

The test was planned to duplicate the work of the previous winter at the same station, with the omission of Lot 4 for the reason above stated. The steers were purchased in the fall, dehorned, carried two weeks on preliminary feed, then divided into three similar lots of 20 each and fed as follows: Lot 1, cottonseed meal and sorghum silage; Lot 2, cottonseed meal, sorghum silage, and corn stover; Lot 3, cottonseed meal, sorghum silage, and oat straw.

CATTLE USED.

Sixty head of steers were selected from various points in Madison County, Miss. They ranged from 2 to 4 years of age and were grade stock, showing Shorthorn, Hereford, Aberdeen-Angus, Red Poll, and Devon breeding, while a trace of Jersey blood was evident in a few of them. At the beginning of the test they averaged 856 pounds per head. They were a thrifty lot of steers and were larger and of better quality than the average in the State.

CHARACTER AND PRICES OF FEEDS USED.

The cottonseed meal used was clean and bright, analyzing about 36 per cent crude protein. The sorghum silage was of fine quality, and very palatable to the cattle. The oat straw had been baled in the fall and put into the barn, so it was bright and of high quality. The corn stover also was very good.

The feeds were charged against the steers at the following prices:

Cottonseed meal	per ton	$33.00
Sorghum silage	per ton	3.00
Corn stover	per ton	5.00
Oat straw	per ton	5.00

The cottonseed meal was purchased early in the fall at the above price. Three dollars per ton covered the cost of growing and putting up the silage. Local market prices were placed upon the stover and straw.

METHODS OF HANDLING AND FEEDING THE CATTLE.

The 60 steers were purchased in October, brought to the farm, and allowed the run of stalk fields and lespedeza meadows. Two weeks before they were put on regular feed they were dehorned and started on a preliminary ration of cottonseed meal and sorghum silage. After dehorning, the flies were very troublesome, which, together with the difficulty of getting some of the steers to eat silage and meal, caused quite material losses in weight.

On November 23, 24, and 25, individual weights of all the steers were secured and the average taken as the initial weights of the steers. During the progress of the experiment each lot was weighed every 28 days, and individual weights were again taken on two consecutive days at the conclusion of the test and averaged for the final weights.

Experimental feeding began on November 24. Feeding was done about 7 a. m. and 5 p. m. each day. Water and salt were supplied as during the previous winter. Dry roughage was kept in the racks for the steers of Lots 2 and 3 at all times, fresh roughage being placed in the racks each morning after the silage was fed.

The lots, sheds, and feeding equipment were the same as those used in the previous winter's experiment.

AVERAGE DAILY RATIONS.

The avearge daily rations per head by 28-day periods, and for the entire feeding period of 128 days, is shown in Table 12.

TABLE 12.—*Average daily ration per head by 28-day periods (Nov. 24, 1916, to Mar. 23, 1917—120 days).*

Lot No.	Number of steers.	Ration.	First period.	Second period.	Third period.	Fourth period.	Fifth period (8 days).	Entire period (120) days).
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	20	Cottonseed meal	2.7	5.1	6.5	7.2	7.7	5.5
		Sorghum silage	34.4	43.2	49.2	49.5	42.8	43.9
2	20	Cottonseed meal	2.7	5.1	6.5	7.2	7.7	5.5
		Sorghum silage	31.3	37.9	40.6	40.5	38.3	37.6
		Corn stover	1.9	3.0	3.3	3.4	2.9	2.9
3	20	Cottonseed meal	2.7	5.1	6.5	7.2	7.7	5.5
		Sorghum silage	32.9	36.4	40.2	39.9	37.4	37.4
		Oat straw	1.8	2.5	2.3	2.4	1.2	2.2

It will be noted that the steers were on feed 120 days. The amount of cottonseed meal fed was uniform for each lot, while the roughages were different for each lot.

All the cattle were started on 2 pounds of cottonseed meal per head daily, which amount was increased during the first 28-day period, so that for this period each steer in the three lots ate an average of 2.7 pounds daily. They were given all the silage they would eat, and in addition Lots 2 and 3 were given what dry roughage they would consume.

Some of the steers had never been fed meal and silage and considerable difficulty was encountered in teaching a few in each lot to eat these feeds. Several head were stall fed for a few days until they became accustomed to the feeds. When they had once started eating well they gave no further trouble.

The allowance of cottonseed meal was increased gradually until in the last period the steers of each lot were getting 7.7 pounds daily per head. The roughage also was increased until the steers were on a full feed of cottonseed meal, after which time less roughage was eaten.

In Lot 2 one pound of corn stover replaced about 2 pounds of silage in the ration. Each pound of oat straw added to the ration of Lot 3 replaced about 3 pounds of silage.

Only about 50 per cent of the corn stover was actually eaten, as most of the dry stalks were refused by the steers. It was estimated that 25 per cent of the straw was likewise refused. These waste feeds were pulled down under the steers' feet and could not be weighed back.

WEIGHTS AND GAINS.

Table 13 gives the average initial and final weights per head for each lot, and the total and daily gains per head:

TABLE 13.—*Weights and gains (Nov. 24, 1916, to Mar. 23, 1917—120 days).*

Lot No.	Ration.	Average initial weight per steer.	Average final weight per steer.	Average total gain per steer.	Average daily gain per steer.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	Cottonseed meal and sorghum silage	856	1,078	222	1.85
2	Cottonseed meal, sorghum silage, and corn stover	856	1,084	228	1.89
3	Cottonseed meal, sorghum silage, and oat straw	856	1,073	218	1.82

The above figures indicate that the addition of stover or oat straw to the cottonseed meal and silage combination had little effect so far as producing gains is concerned. The steers which had corn stover in addition to meal and silage made slightly better gains,

which is contrary to the results for the previous winter. In each test, however, the difference was so small as to be almost negligible. The steers of Lot 3, which were given oat straw, again made the poorest showing. Considering the type of steers used and the amount of feed consumed, the gains were quite satisfactory.

QUANTITY AND COST OF FEED REQUIRED TO MAKE 100 POUNDS OF GAIN.

The quantity and cost of feeds required to produce 100 pounds of gain in the case of each lot of steers are shown in Table 14.

TABLE 14.—*Quantity and cost of feed required to make 100 pounds of gain (Nov. 24, 1916, to Mar. 23, 1917—120 days).*

Lot No.	Ration.	Pounds of feed to make 100 pounds gain.	Cost of feed for 100 gain.
1	Cottonseed meal	299	$8.49
	Silage	2,372	
2	Cottonseed meal	292	8.18
	Silage	1,981	
	Corn stover	155	
3	Cottonseed meal	305	8.42
	Silage	2,057	
	Oat straw	121	

In this feeding trial the use of stover and straw to supplement the silage served to lower slightly the cost of gains by reducing the silage required for the same amount of gain. With the steers of Lot 2 less cottonseed meal was needed to produce 100 pounds of gain than was required when silage was the sole roughage received. However, there are no outstanding variations in these figures.

FINANCIAL STATEMENT.

The cost of the steers in the fall, the cost of feeds to fatten them, the charges for marketing, the gross receipts, and the profits are shown for each lot in the following statement:

Financial statement.

Lot 1, cottonseed meal and sorghum silage:	
To 20 steers, 17,115 pounds, at $5.56 per hundredweight	$951.59
To 13,315 pounds cottonseed meal at $33 per ton	219.70
To 105,590 pounds sorghum silage, at $3 per ton	158.39
To freight, yardage, commission, etc.	103.31
Total expenditure	1,432.99
By sale of 20 steers, 20,340 pounds, at $10.89 per hundredweight	2,215.03
Total profit	782.04
Average profit per steer	39.10

Lot 2, cottonseed meal, sorghum silage, and corn stover:	
To 20 steers, 17,129 pounds, at $5.56 per hundredweight	$952.37
To 13,315 pounds cottonseed meal, at $33 per ton	219.70
To 90,255 pounds sorghum silage, at $3 per ton	135.38
To 7,040 pounds corn stover, at $5 per ton	17.60
To freight, yardage, commission, etc.	103.31
Total expenditure	1,428.36
By sale of 20 steers, 20,370 pounds, at $10.99 per hundredweight	2,238.66
Total profit	810.30
Average profit per steer	40.51
Lot 3, cottonseed meal, sorghum silage, and oat straw:	
To 20 steers, 17,112 pounds, at $4.46 per hundredweight	951.43
To 13,995 pounds cottonseed meal, at $33 per ton	230.92
To 89,679 pounds sorghum silage, at $3 per ton	134.52
To 5,282 pounds oat straw, at $5 per ton	13.21
To freight, yardage, commission, etc.	103.31
Total expenditure	1,433.39
By sale of 20 steers, 20,010 pounds, at $10.77 per hundredweight	2,155.08
Total profit	721.69
Average profit per steer	36.08

The steers were purchased in the fall for $5.56 per hundredweight. After being fed 120 days and held on the farm 8 days longer, they were shipped to the St. Louis market. There the steers of Lot 1, which had been fed cottonseed meal and silage, sold for an average of $10.89 per hundredweight; those of Lot 2 brought $10.99 per hundredweight, while those of Lot 3 sold for $10.77 per hundredweight. The market prices, while not widely different, indicate the relative finish of the steers of the three lots, and the profits were greatest on the steers which were finished best.

The margin of selling was $5.33 per hundredweight for Lot 1, $5.43 for Lot 2, and $5.21 for Lot 3. Such margins would in themselves largely account for the large profit realized from the steers.

The average profit per steer was $39.10 for Lot 1, $40.51 for Lot 2, and $36.08 for Lot 3. These figures indicate the efficiency of the rations used. At the same time the wide margin realized between the buying and selling prices must be considered one of the chief factors determining the large profit.

The steers fed cottonseed meal, silage, and corn stover made the largest profit, and the steers fed cottonseed meal, sorghum, silage, and oat straw made the smallest profit.

SHRINKAGE AND SLAUGHTER DATA.

As stated before, the experimental feeding was concluded March 24, at which time the supply of silage was exhausted. The steers were held until April 1 in order to appear for a farm demonstration at the Canton Stock Farm. Silage for the steers during this time

was purchased from neighbors, but changing feed, driving, and the excitement caused by crowds of farmers made all the cattle lose weight between March 24 and April 1. For this reason the average final farm weights shown in Table 15 do not coincide with those shown in Table 13.

The steers were weighed at 7 a. m., April 1, driven two miles to the loading station, and were on their way at 11 a. m. They arrived at the St. Louis stockyards at 2 p. m., April 3, having been in transit about 54 hours.

The average shrinkage per head was low for the time in transit, but the steers had been losing weight during the days previous to shipping, which accounts for the comparatively low shrinkage. The amount of shrinkage varied only slightly, being highest in Lot 1 and lowest in Lot 2.

The steers were given feed and water in the yards during the afternoon and night of April 3, and were sold the following morning. They were slaughtered the next day, April 5, and the carcass weights recorded as below:

TABLE 15.—*Slaughter data.*

Lot No.	Ration.	Average farm weight per steer.	Average market weight per steer.	Average shrinkage in transit.		Average weight of carcass.	Per cent dressed.	
							By farm weights.	By market weights.
		Pounds.	*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*	*Per cent.*
1	Cottonseed meal and sorghum silage	1,067	1,017	50	4.68	598	55.10	57.81
2	Cottonseed meal, sorghum silage, and corn stover	1,064	1,019	45	4.23	593	55.73	58.19
3	Cottonseed meal, sorghum silage, and oat straw	1,048	1,001	47	4.47	578	55.15	57.74

The carcasses were well covered with fat and were pronounced by the butchers as well finished. Little variation was found in the degree of finish of the different lots of steers, as the dressing percentages show. It will be noted that these dressing percentages are rather high for this class of cattle, which speaks well for the efficiency of the rations fed.

SUMMARY OF THE EXPERIMENT.

1. The objects of this feeding test were to study the effect of a supplemental allowance of corn stover and oat straw to a basic ration of cottonseed meal and silage for fattening mature steers, and to furnish data by which former work of a similar nature might be checked.

2. The work was planned so that it would be a repetition of the test of the winter of 1915–16.

3. The steers used were mature twos, threes, and fours, carrying from one-fourth to three-fourths pure blood of the various beef breeds, including the Devon and Red Poll. They were better steers than the average found in the State.

4. The steers were divided into three lots of 20 each and fed as follows: Lot 1, cottonseed meal and sorghum silage; Lot 2, cottonseed meal, sorghum silage, and corn stover; Lot 3, cottonseed meal, sorghum silage, and oat straw.

5. Equal quantities of cottonseed meal were fed to the steers of the three lots, beginning at 2 pounds per head, and increased to 7.7 pounds during the latter part of the feeding period. The steers of Lot 1 ate an average daily ration of 43.9 pounds of silage, while those of the other two lots consumed practically 6 pounds less daily per head, which amount was replaced by a daily consumption of 2.9 pounds of corn stover per head in the case of Lot 2, and 2.2 pounds of oat straw in Lot 3.

6. The average daily gains per head for the 120-day feeding period were 1.85 pounds, 1.89 pounds, and 1.82 pounds for the steers of Lots 1, 2, and 3, respectively. Thus it is seen that the addition of stover and straw had very little effect upon the rate of gains.

7. The cost per 100 pounds gain was $8.49, $8.18, and $8.42, for Lots 1, 2, and 3, respectively. These gains were put on cheaply, and there is very little variation in the costs in the different lots. The addition of stover and straw to the cottonseed-meal and silage combination lowered the cost of gains slightly.

8. The relatively cheap cottonseed meal and silage, combined with the extremely wide margin of selling, largely accounts for the high profits realized from feeding these steers. The average profit per steer, after deducting the cost of feeds and marketing, was $39.10, for Lot 1, $40.51 for Lot 2, and $36.08 for Lot 3.

9. The steers in Lot 1 dressed out 57.81 per cent, those in Lot 2, 58.19 per cent, and those of Lot 3, 57.74 per cent, which indicates well-finished carcasses.

V. SUMMARY AND CONCLUSIONS OF THE FOUR YEARS' WORK.

SUMMARY OF RESULTS.

Table 16 shows in condensed form the chief features and results of the four years' work and permits an easy study and comparison of the figures:

TABLE 16.—*Summary table of four years' steer feeding.*

Group I.	Lot 1.—Cottonseed meal and cottonseed hulls.		Lot 2.—Cottonseed meal and corn silage.		Lot 3.—Cottonseed meal, cottonseed hulls, and corn silage.	
	1913–14	1914–15	1913–14	1914–15	1913–14	1914–15
Number of steers	20	25	20	26	20	26
Number of days fed	84	143	84	143	84	143
Average daily gain per head.....pounds..	2.48	1.38	2.51	1.15	2.58	1.67
Average cost of feed per 100 pounds gain...	$8.88	$10.70	$6.19	$11.26	$7.89	$8.90
Average selling margin	$1.50	$1.68	$1.50	$1.78	$1.50	$1.83
Average profit per head	$5.99	[1] —$1.62	$11.74	$2.27	$7.69	$2.13

Group II.	Lot 1.—Cottonseed meal and sorghum silage.		Lot 2.—Cottonseed meal, sorghum silage, and corn stover.		Lot 3.—Cottonseed meal, sorghum silage, and oat straw.		Lot 4.—Cottonseed cake, cowpea hay, oat straw, and corn stover.	
	1915–16	1916–17	1915–16	1916–17	1915–16	1916–17	1915–16	1916–17
Number of steers fed.	20	20	20	20	20	20	20	.....
Number of days fed..	127	120	127	120	127	120	127	.....
Average daily gain per head..pounds..	2.14	1.85	1.95	1.89	1.89	1.82	1.59	.....
Average cost of feed per 100-pound gain.	$7.52	$8.49	$8.26	$8.18	$8.47	$8.42	$11.16	.....
Average selling margin	$3.45	$5.33	$3.45	$5.43	$3.45	$5.21	$3.17	.....
Average profit per head	$16.71	$39.10	$14.73	$40.51	$14.80	$36.08	$6.46	.....

[1] Minus sign shows a loss.

FIRST TWO WINTERS' FEEDING.

Inspection of the data presented in the first group shows that there was a difference of nearly two months in the feeding period for the two years and that the average daily gains were much greater for the steers fed only 84 days. The short-fed steers received a heavier ration and, notwithstanding the fact the meal and hulls cost more per ton than they did the following year, they made gains more cheaply in all the lots. They also were sold on a narrow margin but returned much larger profits than the steers fed in the succeeding winter.

Comparison of the results secured by the use of the different rations indicates a slight advantage in the rate and cost of gains produced in favor of the ration of meal, silage, and hulls (Lot 3). But it will be recalled that the poor showing made during the second year's trial was due chiefly to the muddy condition of the lots and to the poor quality of the silage, the latter disadvantage reflecting most severely on the steers of Lot 2, which had no other roughage. Yet the steers fed only cottonseed meal and silage made the largest profit in each instance. The ration of cottonseed meal and hulls (Lot 1) proved the least satisfactory of the three rations tried, as the steers of this lot returned the least profit the first year and lost money in the second year. All the steers were sold on narrow margins, and the profits were only moderate.

LAST TWO WINTERS' FEEDING.

In the last two winters' feeding, the data of which are given under Group II of the summary table, the feeding periods for the two years were practically equal, the conditions for feeding improved, and all the feed was of high quality.

Omitting Lot 4, which was carried only one year, the figures show that larger gains were made in each lot in the third year, 1915–16, chiefly owing to the heavier ration of cottonseed meal for that year. The cost of gains was quite uniform in each lot during the two years' trials, the largest variation being in Lot 1, where the difference was $0.97 per 100 pounds. The wide margins on which all the steers were sold in the last two years' tests are outstanding, ranging from $3.17 to $5.43 per 100 pounds. These large margins, together with good gains produced economically, are responsible for the remarkable profits realized on these cattle. The differences in profits shown in each lot for the two years are due mainly to the larger selling margins realized on the steers the last year.

The results obtained from feeding the different rations show that the steers of Lot 1, fed cottonseed meal and sorghum silage, made the most rapid gains and made them more cheaply than the steers of any other lot. The ration of cottonseed meal, silage, and corn stover proved to be a little less efficient than cottonseed meal and silage alone, while the meal and silage supplemented with oat straw, which was fed to Lot 3, did not produce quite so rapid or so cheap gains as the second ration. The ration of cottonseed meal and dry roughages, which was given to Lot 4, did not produce results satisfactory as to rate and cost of gains.

The profits from the various lots show that the first three rations were successfully fed, there being practically no difference in Lots 1 and 2, which returned the most profits. Lot 3, because of slightly

smaller and more expensive gains, returned a smaller profit, while Lot 4 would have been fed at a loss had it not been for the wide selling margin.

CONCLUSIONS.

The four years' feeding work with southern steers furnishes data from which some valuable conclusions may be drawn.

1. The outstanding efficiency of corn or sorghum silage in rations for fattening steers is distinctly brought out by these feeding tests. Good gains are produced economically by the use of cottonseed meal and silage, or cottonseed meal and silage supplemented with dry roughage, such as cottonseed hulls, corn stover, or oat straw. However, satisfactory results in finishing steers for the block can not be expected from silage of poor quality.

2. A ration of cottonseed meal and cottonseed hulls produces less rapid and more expensive gains in fattening steers than a ration in which good silage forms all or most of the roughage portion of the ration. If hulls are available at a reasonable price, they can be used economically to supplement a ration composed chiefly of cottonseed meal and silage.

3. Cattle receiving cottonseed meal and a heavy feed of silage eat only a small quantity of dry roughage, such as corn stover or straw, but the consumption of such roughage reduces the total amount of silage consumed.

4 The use of cheap dry roughage for supplementing a silage ration has little effect on the rate or economy of gains. When such feeds are available on the farm and are not needed for wintering stock or for breeding animals, they should be utilized as supplements in the rations of fattening cattle.

5. Cottonseed meal or cake supplemented with dry roughage, such as cowpea hay, straw, and stover, does not produce as rapid or economical gains on steers as rations containing a generous quantity of corn or sorghum silage.

6. It is often more profitable to feed heavy rations over a short period, as was done in the winter of 1913–14, than to feed lighter rations over a longer period. The condition of the steers when feeding begins and the market price are the chief factors that will determine whether the steers are to be fed over a short or a long feeding period.

7. In these experiments feeding pens and lots which were fairly dry and furnished dry sleeping quarters were conducive to better gains on the steers than those which were muddy.

8. Steers having the best finish brought the highest prices per 100 pounds and returned the most profit. This indicates that it is a safe policy for the feeder to finish his cattle well.

9. Cattle sold on large margins usually bring good profits, even if the cost of finishing has been high. Hence, buying feeders at right prices, or raising them economically, chiefly on farm-grown feeds, such as silage, stover, straw, and pasture, will usually insure a satisfactory financial outcome.

10. Taken as a whole, the results of the tests reported in this bulletin show that the southern farmer can feed steers on cottonseed meal or cake and corn or sorghum silage, with or without other farm-grown roughage, and produce satisfactory gains at comparatively cheap cost, and can market well-finished steers for good prices if he is in a tick-free section. By so doing he not only utilizes his farm-grown crops but adds to his farm in the form of manure the fertilizing elements of the cottonseed meal fed, thus carrying out a system of diversified, permanent, and profitable farming.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D.C.
AT
5 CENTS PER COPY

▽